87-e15

Segment No. 26-00-02

WA-CR-1028

SCREENING SURVEY FOR CONTAMINANTS IN GROUND WATER AND SURFACE DRAINAGE AT THE PORT OF PASCO

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ABSTRACT

Petroleum contamination of ground water at the Port of Pasco was not resulting in significant discharge of petroleum hydrocarbons to surface waters. The Port appeared to be the source of the chlorinated compounds 1,2-dichloropropane (66 ug/L), 1,1,1-trichloroethane (20-21 ug/L), and tetrachloroethene (10 ug/L) detected in downstream drainage waters. The source of 1,2-dinitrophenol, pentachlorophenol, and isophorone in sediments below the Port was not clear.

INTRODUCTION

A series of water and sediment samples were collected at the Port of Pasco on September 30, 1986, and January 26, 1987, to evaluate the extent to which petroleum contamination of the ground water was impacting downstream surface waters, and to screen for the presence of other toxic chemicals. The survey was conducted with the assistance of Carl Nuechterlein and Larry Peterson of the Eastern Regional Office. Results from analyses of these samples are reported below. Some data from an earlier Ecology survey at this site (Johnson and Norton, 1986) are also discussed, but analytical problems compromised the quality of most of the data from that effort.

BACKGROUND

The Port of Pasco is located on the left bank of the Columbia River at the old highway bridge between Pasco and Kennewick (see Figure 1). The history of petroleum contamination at this site and an evaluation of the problem as of 1973 were reported by Russell (1973). A tank farm was started here in the 1930s. Numerous petroleum spills are known to have occurred since at least 1957. Russell found a pool of mixed petroleum products extending from the Columbia River levee to Washington Street in a north-south direction and 6th Street to 11th Street in an east-west direction. Pool thickness varied from two to six inches. Eight or more petroleum-handling companies were considered potential sources of contamination.

The water table at the Port of Pasco is three to six feet below the ground surface. Direction of ground water movement is to the southwest where it is intercepted by a 42- to 48-inch perforated drain pipe installed near the base of the levee by the Army Corps of Engineers. A 25- to 40-foot deep trench filled with bentonite clay underlies the levee and retards ground water movement to the Columbia River (Russell, 1973). The drain pipe conveys ground water and petroleum to an open ditch about 1500 feet in length which empties into a collection reservoir. From there, the water is pumped to the Columbia River. An oil/water separator maintained by Columbia Marine Lines is at the upper end of the ditch. The reservoir is commonly referred to as Juvenile Pond, having once been stocked for children's fishing.

The Port constructed three 24-inch diameter wells in the early 1970s to monitor the petroleum. Attempts at recovery were made, but with little success. Until recently the only monitoring has been a check

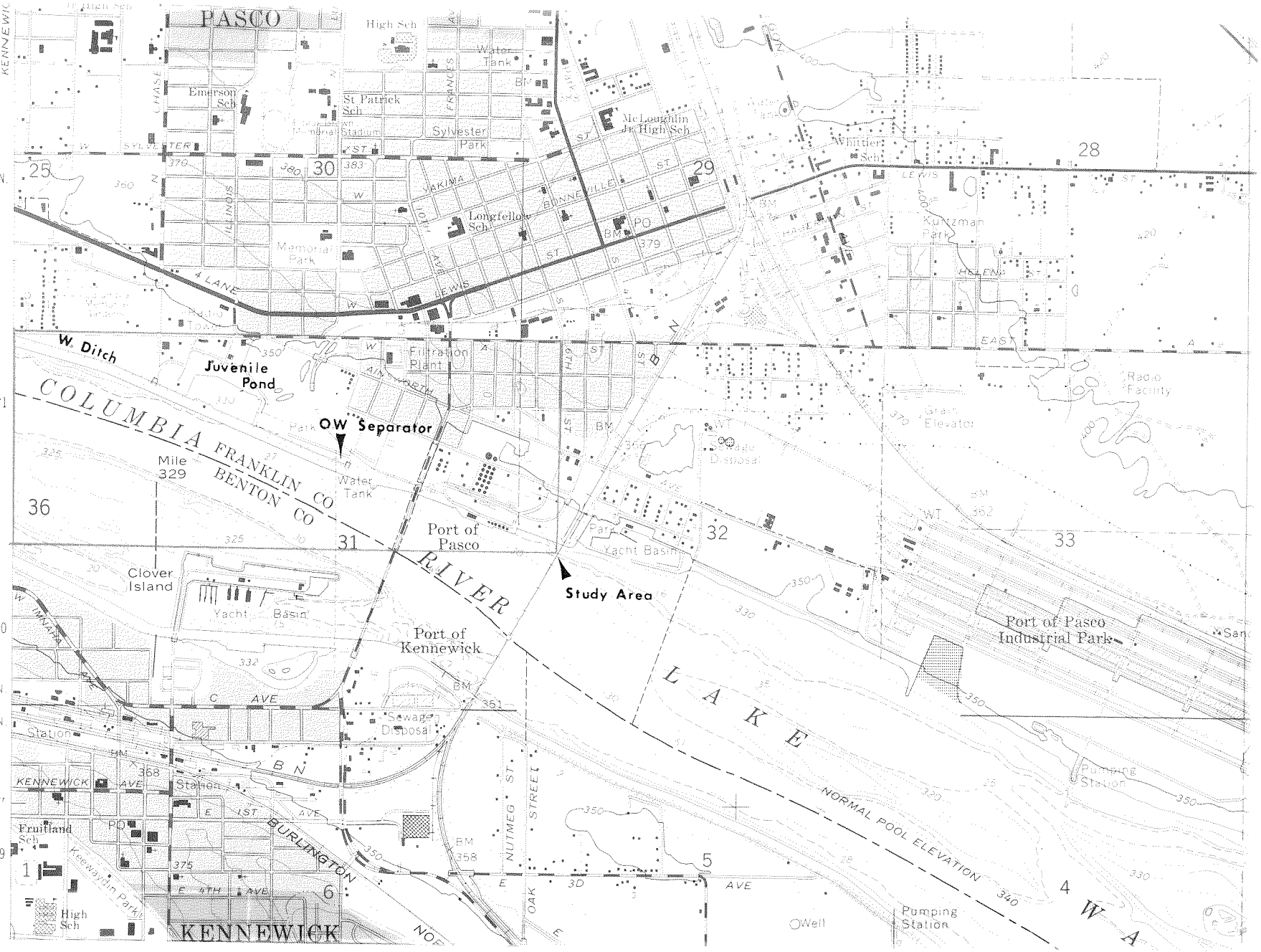

Figure 1. Port of Pasco.

for oil; no records were kept. Geoengineers Inc., a consultant hired by the Port, installed a series of monitoring wells at the site in early 1987. Preliminary results (Appendix I) indicate the east-west extent of the petroleum pool is less than that described by Russell. The pool appears to be thickest, 1.41 to 1.80 feet, along its southwest (down-gradient) edge.

Russell (1973) suggested fluctuations in the level of the McNary Pool influence movement of petroleum, in that rising and falling water levels may act to pump petroleum from the site. The present survey was conducted at a period of minimum pool.

Columbia Marine Lines and McCall Oil currently store petroleum products at the Port. Columbia Marine Lines also handles the pesticides Telone II (1,2-dichloropropane/1,3-dichloropropene), Telone C-17 (1,3-dichloropropene/chloropicrin), and Vapam (sodium methyldithiocarbamate).

METHODS

Sampling locations are shown in Figure 2. The main survey was conducted September 30, 1986. Ground water samples were collected from observation wells No. 1 and 2 near the Columbia Marine Lines office and from the drain upstream of the petroleum pool via manhole No. 2. (The numbering system follows Russell; well No. 3 has been filled in.) Surface water samples were collected immediately below the oil/water separator, at the mouth of a second ditch that enters Juvenile Pond from the west, and at the inlet structure of the pump station. (There is a storm drain discharge on the north shore of the pond, but it was dry during the survey.) A Marsh-McBirney magnetic flow meter and top-setting rod were used to measure flows in the ditch below the oil/water separator at a point just above Juvenile Pond and at the mouth of the West Ditch. Sediment samples were collected at the east end, center, and west end of Juvenile Pond.

Ground water was sampled using a peristaltic pump and teflon tubing. The pump was equipped with a short section of silastic tubing. The system was cleaned with 10 percent nitric acid, pesticide-grade methylene chloride and acetone, and de-ionized water before use. Samples were obtained by lowering the teflon tubing below the petroleum layer while maintaining positive pressure on the pump, reversing the pump, and then flushing the system several minutes before taking samples. New tubing was used for each well. The wells were not purged prior to sampling. Thickness of the petroleum layer was measured from the cut taken by a teflon well bailer. Water samples from the manhole and surface water samples were collected directly into sample bottles.

Sediment samples were collected with a Ponar grab. The top 2-cm layer was removed with stainless steel spoons and homogenized in stainless steel beakers before splitting into subsamples. All sediment sampling equipment was cleaned as described above for the pump system. Samples for semi-volatiles and pesticide/PCB analyses were not analyzed within approved holding times which necessitated re-sampling the pond sediments on January 26, 1987.

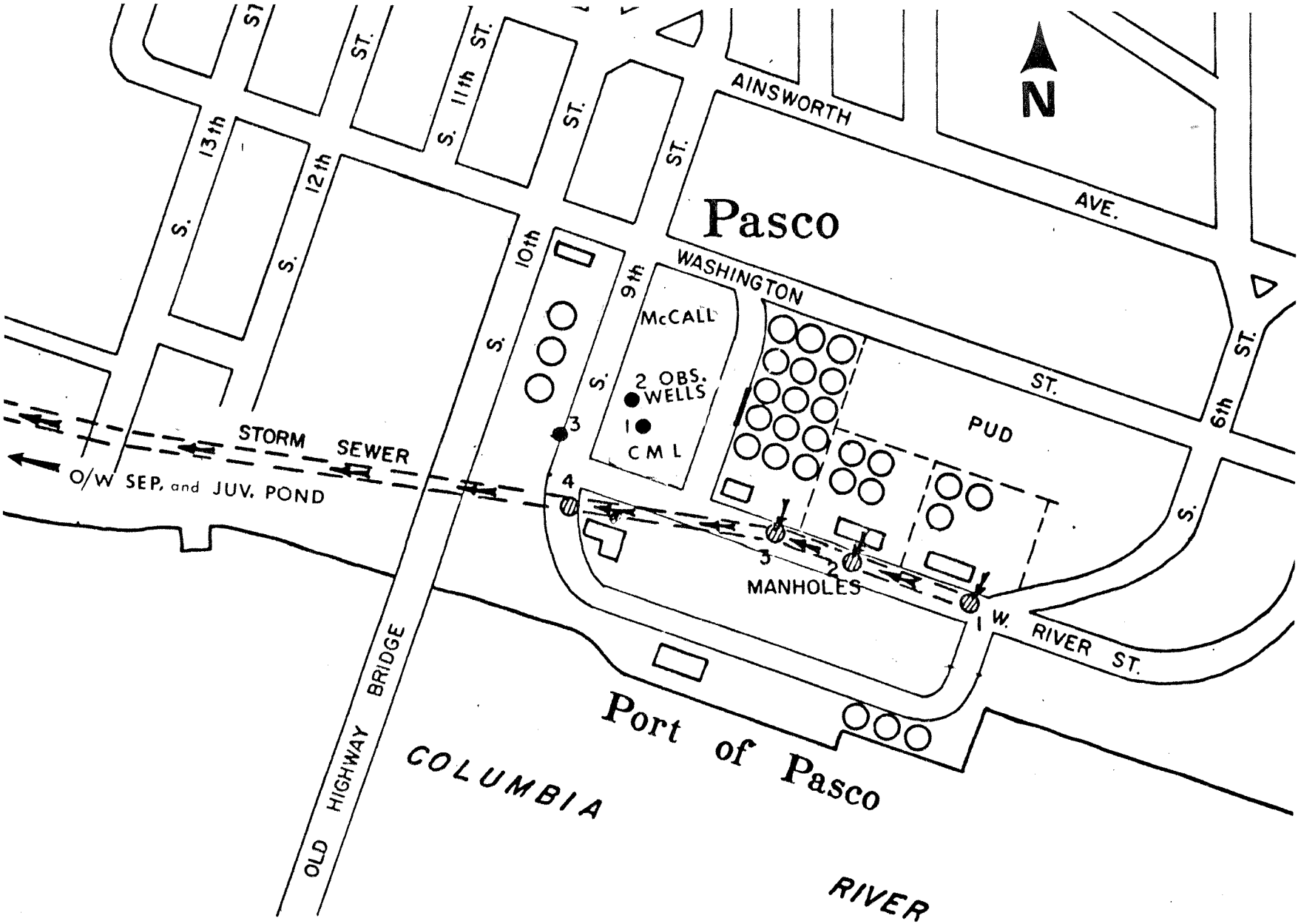

Figure 2. Sample locations at Port of Pasco.

Sample containers for priority pollutant analyses (volatiles, semi-volatiles, pesticides/PCBs, and metals) and analysis of organic carbon in sediment were glass jars with teflon lid-liners (I-Chem, Hayward, CA), except water samples for metals which were polyethylene cubitainers (also I-Chem). Water samples for pH, specific conductivity, hardness, and suspended solids were collected in 1-liter polyethylene bottles. Containers for organic carbon in water were glass with telfon lid-liners and had HNO_3 for preservative. All samples were placed on ice immediately after collection and kept refrigerated until analyzed. Water samples for metals analysis were preserved with HNO_3 on return to the laboratory except mercury samples which were preserved in the field.

Samples were analyzed at the Ecology/EPA Environmental Laboratory at Manchester, except volatiles which were done at Analytical Resources Inc., Seattle, and total organic carbon in sediment which was done at Laucks Laboratory Inc., Seattle. Table 1 summarizes the analyses conducted.

Table 1. Analysis of Port of Pasco samples collected September 30, 1986, and January 26, 1987.

Analysis	Method	Method Number	Reference
-Water samples-			
temperature (field)	precision thermometer	--	--
pH (lab)	Corning 155 meter	423	APHA (1985)
specific cond. (lab)	Beckman RC20 meter	205	"
tot. hardness (as CaCO3)	EDTA titration	314B	"
tot. suspended solids	gravimetric	205C	"
tot. organic carbon	combustion/infrared detection	505	"
volatiles	GC/MS	624	EPA (1984)
semi-volatiles	"	625	"
pesticides/PCBs	GC/EC	608	"
mercury*	cold vapor/AA	785	EPA (1985)
cadmium*	AA	"	"
lead*	"	"	"
-Sediment samples-			
total organic carbon	combustion/CO2 measurement	Laucks in-house	
semi-volatiles	GC/MS	8270	EPA (1984)
pesticides/PCBs	GC/EC	608	"
mercury*	cold vapor/AA	785	EPA (1985)
cadmium*	AA	"	"
lead*	"	"	"

*total recoverable metal

The quality of the data was assessed through matrix spikes, duplicates analyses, field replicates, method blanks, and field blanks. The following data quality concerns were identified:

- Holding time for extraction was exceed by one to six days for semi-volatiles and 31 to 37 days for pesticides/PCBs. The semi-volatiles data on water samples are flagged as such in this report. No pesticides or PCB's were detected in water. As previously mentioned, Juvenile Pond sediments were re-sampled and analyzed a second time for semi-volatiles and pesticides/PCBs, the assumption being that sediment analysis would likely detect compounds from either group if discharged in significant amounts. Results from the initial sediment analyses were not used.

- Four organic compounds were detected in both blank samples and field samples (Table 2). Methylene chloride was used to clean sample containers and sampling equipment. Bis(2-ethylhexyl)-phthalate and n-nitrosodiphenybimine/diphenylamine were in the range of blanks for water and sediment samples, respectively. Therefore, these three compounds are not reported as present in the field samples. Bis(2-ethylhexyl)phthalate and pentachlorophenol are, however, reported as present in sediment (and flagged for detection in blanks) because sample concentrations substantially higher than blank values were measured, and because pentachlorophenol was detected in sediment samples collected in the 1985 survey (Appendix II).

RESULTS

Depths from the top of the well casings to the surface of the petroleum overlying the ground water were 6.5 feet in well No. 1 and 6.2 feet in well No. 2. Petroleum layer thicknesses were 1.0 foot and 0.7 foot, respectively.

The results of water sample analyses are summarized in Table 3. Ground water from both wells contained aromatic hydrocarbons and phenolic compounds indicative of petroleum. Aromatic hydrocarbon concentrations ranged from 33,000 ug/L of benzene to 14 ug/L of 2-methylnaphthalene. Substituted benzenes and indene were also tentatively identified. The two cresols detected--4-methylphenol and 2,4-dimethylphenol--were at concentrations of 15-21 ug/L and 230 ug/L, respectively. Cadmium and lead were elevated in both wells, also probably a result of petroleum contamination. Because of the potential for contamination in lowering the teflon sampling tube through the petroleum layer, these data represent the types of contaminants potentially present in the ground water, rather than absolute concentrations.

There was no evidence of petroleum contamination in the drain at manhole No. 2 upstream of the wells. Traces of the chlorinated hydrocarbons 1,1,1-trichloroethane and tetrachloroethene (each estimated at 2 ug/L) were the only organic compounds detected. Mercury, cadmium, and lead concentrations were near or below detection limits.

Low concentrations (0.18 - 5.5 ug/L) of petroleum hydrocarbons were measured in water collected downstream of the wells immediately below the oil/water separator. Substituted benzenes and naphthalenes were also tentatively identified. An oily sheen was visible at the point

Table 2. Compounds detected in both blanks and field samples for September 1986 (water) and January 1987 (sediment) Port of Pasco collections (ppb).

	Blank Samples			Field Samples		
Compound	Method	Transport	Transfer	Concentration	Sample Number	Location
-W A T E R-						
Methylene chloride	2J; 4J; 11	6	7	1900J	40-8329	Well No. 2
	2J; 4J; 11			3J	40-8330	Manhole No. 2
Bis(2-ethylhexyl) phthalate	5.5u	2.1u	0.40J	1.4	40-8330	Manhole No. 2
				0.29J**	40-8333	Blw oil/water separator
				0.55J**	40-8334	Blw oil/water separator (repl)
-S E D I M E N T-						
Bis(2-ethylhexyl) phthalate	57J	N/A	N/A	48J	05-8003	West end juvenile pond
				780	05-8002	Center juvenile pond
N-Nitrosodiphenylamine and/or diphenylamine	17J; 22J	N/A	N/A	32J	05-8000	East end juvenile pond
				66J	05-8001	East end juvenile pond (repl)
				68J	05-8002	Center juvenile pond
				49J	05-8003	West end juvenile pond
Pentachlorophenol	33J	N/A	N/A	120J	05-8003	West end juvenile pond

** = Holding time to extraction exceeded
u = Not detected at detection limit shown
J = Estimated concentration
N/A = Not applicable.

Table 3. Analytical results for water samples collected at the Port of Pasco on September 30, 1986.

Sample Location	Well No. 1	Well No. 2	Manhole No. 2	Below Oil/water Separator		West Ditch	Juvenile Pond Outlet
Sample Number	40-8328	40-8329	40-8330	40-8333	40-8334	40-8335	40-8336
Flow (cfs)	--	--	--	0.72	--	18	--
Temperature (^{o}C)	--	--	17.2	16.1	--	16.6	15.6
pH (S.U.)	6.9	6.7	7.4	7.4	7.4	7.8	7.7
Specific Cond. (umhos/cm)	1,600	529	433	540	544	597	614
Total Hardness (mg/L)	810	300	230	270	260	290	300
Total Suspended solids (mg/L)	70	45	<1	<1	<1	<1	4
Total Organic Carbon (mg/L)	130	54	1.7	2.8	5.3	3.9	3.0
Aromatic Hydrocarbons (ug/L)							
Benzene	5,000	33,000	5u	5u	5u	5u	5u
Toluene	5,000	31,000	5u	5u	5u	5	5u
Ethylbenzene	2,750	800J	5u	5u	5u	5u	5u
Total xylenes	25,000	15,000	5u	5u	5u	5u	5u
Naphthalene	510**	53**	2.0u	2.5**	3.0**	3.0u**	1.9u**
2-Methylnaphthalene	370**	14J**	2.0u	4.5**	5.5**	3.0u**	1.9u**
Phenanthrene	93u**	9.3u**	2.0u	0.51J**	0.62J**	3.0u**	1.9u**
Fluorene	93u**	9.3u**	2.0u	0.48J**	0.56J8**	3.0u**	1.9u**
Dibenzofuran	93u**	9.3u**	2.0u	0.18J**	0.20J**	3.0u**	1.9u**
Trimethylbenzene* (or isomers)	27,200**	1,690**	ND	145**	128**	ND**	ND**
Tetramethylbenzene* (or isomers)	1,400**	ND**	ND	14**	16**	ND**	ND**
IH-Indene, 2,3-dihydro-1-methyl*	ND**	64**	ND	ND**	ND**	ND**	ND**
1-Methylnaphthalene*	ND**	ND**	ND	33**	36**	ND**	ND**
Dimethylnaphthalene*	ND**	ND**	ND	present**	19**	ND**	ND**
1,2,3,4-Tetrahydronaphthalene*	ND**	ND**	ND	ND**	7**	ND**	ND**
Phenols (ug/L)							
4-Methylphenol	93u**	15**	20u	1.9u**	2.5u**	3.0u**	1.9u**
2,4-Dimethylphenol	230**	21**	2.0u	1.9u**	2.5u**	3.0u**	1.9u**
Chlorinated Hydrocarbons (ug/L)							
1,2-Dichloropropane	250u	250u	5u	66	66	5u	5u
1,1-Dichloroethane	250u	250u	5u	2T	3T	5u	5u
1,1,1-Trichloroethane	250u	250u	2J	21	20	5u	5u
Tetrachloroethene	250u	250u	2J	10	10	5u	1T
Metals (ug/L)							
Mercury	0.17	0.09	0.09u	0.09u	0.09u	0.09u	0.09u
Cadmium	39.1	15.6	0.2u	0.5	0.2u	0.2u	10.3
Lead	153	279	1u	1u	1u	1u	1u

** = Holding time to extraction exceeded
u = Not detected at detection limit shown
J = Estimated concentration
ND = Not detected
T = "Hit" not acceptable by EPA protocol, but considered "real" by analyst
* = Tentatively identified compound

these samples were collected. Single-ring aromatic compounds (benzene through xylenes) were not detected below the oil/water separator. This may be due to weathering of these volatile compounds or failure to include the surface layer in the samples for volatiles analysis.

Four chlorinated hydrocarbons--1,2-dichloropropane (66 ug/L), 1,1-dichloroethane (2 - 3 ug/L), 1,1,1-trichloroethane (20 - 21 ug/L), and tetrachloroethene (10 ug/L)--were detected below the oil/water separator. Two of these compounds, 1,2-dichloropropane and 1,1-dichloroethane, were not detected at manhole No. 2 upstream. In the case of 1,1-dichloroethane this may be a function of detection limits, but 1,2-dichloropropane appears to be originating at the Port, probably from Columbia Marine Lines' handling of the soil fumigant Telone II. 1,1,1-Trichloroethane and tetrachloroethene concentrations were five to ten times higher below the oil/water separator than in upstream samples, which suggests additional input of these compounds from an unknown source(s) at the Port.

Metals concentrations below the oil/water separator were near or below detection limits. Results from analysis of replicate samples collected at this site were in good agreement for both organics and metals.

Flow in the West Ditch to Juvenile Pond was an order of magnitude higher than the drain coming out of the Port. The only contaminant detected was a trace (5 ug/L) of toluene.

Although a very slight sheen was visible on the surface of Juvenile Pond, no petroleum compounds were detected at its outlet. Of the four chlorinated compounds present in discharges to the pond, only tetrachloroethene was detected (1 ug/L) at the outlet.

A high cadmium concentration (10.3 ug/L) was measured at the Juvenile Pond outlet. Cadmium was below detection limits in both discharges to Juvenile Pond. Cadmium was also not detected (0.1 ug/L detection limit) in any of the water samples collected in 1985 (Appendix II). The Manchester laboratory was asked to review their analysis on this sample and found no errors.

With the exception of cadmium, none of the contaminant concentrations measured in Port of Pasco surface waters exceed EPA criteria for protection of freshwater life (Table 4). EPA has no specific water quality criteria for substituted benzenes, substituted naphthalenes, phenanthrene, fluorene, or dibenzofuran.

Table 4. EPA water quality criteria for contaminants detected in surface water samples collected at the Port of Pasco September 30, 1986 (ug/L).

Chemical	Acute criteria	Chronic criteria
Benzene	5,300	no criteria
Toluene	17,500	no criteria
Naphthalene	2,300	620
Polynuclear aromatic hydrocarbons	no criteria*	no criteria
1,2-Dichloropropane**	23,000	5,700
1,1-Dichloroethane**	118,000	20,000
1,1,1-Trichloroethane**	18,000	9,400
Tetrachloroethene	5,280	840
Cadmium	1.0	0.15

*EPA saltwater criteria for PNA's is 300 ug/L
**Criteria shown are for dichloropropanes, 1,2-dichloroethane, and trichloroethanes, respectively

The data obtained on Juvenile Pond sediments are in Table 5. Eight polynuclear aromatic hydrocarbons (13 - 220 ug/kg), pentachlorphenol (120 ug/kg), 2,4-dinitrophenol (93 ug/kg), PCB-1254 (10-13 ug/kg), isophorone (32-91 ug/kg), benzoic acid (200-1100 ug/kg), and bis(2-ethylhexyl)phthalate (481-780 ug/kg) were detected in the sediments. A ketone, dimethlycyclohexenone, was tentatively identified. For those chemicals where detection limits allow comparison of concentrations between sampling sites (aromatic hydrocarbons, PCBs, isophorone, and dimethylcyclohexenone), no gradients are apparent that point to the Port as a source. The organic compounds present in discharges to the pond were not detected in the sediments. This is not unexpected in light of the low concentrations and volatile nature of the compounds in question.

Circumstantial evidence suggests a potential relationship between the Port's handling of pesticides and the occurrence of isophorone and 2,4-dinitrophenol in pond sediments because uses for these compounds include, but are not limited to, pesticide manufacture. Isophorone is used as a solvent for pesticide formulations. 2,4-Dinitrophenol is an impurity in the herbicide DNPP (2-isopropyl-4,6-dinitrophenol) and may be produced through photodegradation of pesticides containing dinitrophenol (EPA, 1980).

The significance of the level of contamination in Juvenile Pond sediments is difficult to evaluate without bioassay or other biological assessment as there are no criteria for sediment analagous to the EPA water quality criteria. The presence of large numbers of suckers (Catastomus spp.) and carp (Cyprinus carpio) argue against the sediments being very toxic. Carp muscle tissue analyzed in 1985 (Appendix II) had moderate concentrations of PCB-1254 (300 ug/kg), and low concentrations of DDE (35 ug/kg), mercury (38 ug/kg), cadmium (<3 ug/kg), and lead (162 ug/kg); aromatic hydrocarbons and pentachlorophenol were not detected (400 ug/kg detection limit). The concentrations of aromatic hydrocarbons, pentachlorophenol, PCBs, mercury,

Table 5. Analytical results for sediment samples collected from Juvenile Pond, Port of Pasco, on September 30, 1986 (sample numbers 40-8324 through 40-8327), and January 26, 1987 (sample numbers 05-8000 through 05-8003).

Sample Location	East End		Center	West End
Sample Number	40-8324	40-8325	40-8326	40-8327
Percent Dry Weight	43	46	31	56
Percent Ash Weight	95	95	92	96
Total Organic Carbon (dry weight basis)	3.1	3.1	3.2	3.4
Sample Number	05-8000	05-8001	05-8002	05-8003
Aromatic Hydrocarbons (ug/kg, dry)				
Anthracene	230u	210u	88J	150u
Chrysene	210u	210u	130J	150u
Pyrene	190J	150J	220J	150u
Fluoranthene	120J	120J	200J	13J
Benzo(a)anthracene	210u	210u	120J	150u
Benzo(a)pyrene	210	210u	110J	150u
Benzo(b)- and/or benzo(k)-fluoranthene	210J	140J	220J	18J
Phenols (ug/kg, dry)				
2,4-Dinitrophenol	1,100u	1,000u	1,200u	93J
Pentachlorophenol	1,100Bu	1,000Bu	1,200Bu	120BJ
Chlorinated Hydrocarbons (ug/kg, dry)				
PCB-1254	10J	10J	13	10J
Miscellaneous Organics (ug/kg, dry)				
Isophorone	81J	54J	91J	32J
Benzoic acid	1,100u	200J	1,200u	1,100
Bis(2-ethylhexyl)phthalate	230Bu	210Bu	780B	481BJ
3,5-Dimethyl-2-cyclohexen-1-one*	3,800J	4,800J	34,000J	5,900J
Sample Number	40-8324	40-8325	40-8326	40-8327
Metals (mg/kg, dry)				
Mercury	0.033	0.007	0.013	0.014
Cadmium	0.4	0.4	0.6	0.2
Lead	14	17	58	13

u = Not detected at detection limit shown
J = Estimated concentration
B = Also detected in blank(s)
* = Tentatively identified compound

cadmium, and lead in the pond sediments are below thresholds at which sediment toxicity appears to occur in Puget Sound sediments (Tetra Tech, 1986). The metals concentrations are in the range of background.

The results from this survey generally substantiate those of 1985, confirming the following findings from that initial effort (Appendix II):

- 1,2-Dichloropropane (39 - 47 ug/L), 1,1,1-trichloroethane (27 - 31 ug/L), and tetrachloroethene (11 - 13 ug/L) detected below the oil/water separator but not at manhole no. 2 upstream
- Low concentrations (1 - 16 ug/L) of aromatic hydrocarbons below the oil/water separator
- No significant contamination in the West Ditch
- Pentachlorophenol (860 ug/kg) detected in sediment at the west end of Juvenile Pond
- Tetrachloroethene (3.7 ug/L) only organic compound detected in the Juvenile Pond discharge

CONCLUSIONS

Although there is substantial petroleum contamination of ground water at the Port of Pasco, our surveys in 1985 and 1986 have not documented significant off-site discharge. 1,2-Dichloropropane; 1,1,1-trichloroethane; and tetrachloroethene have been detected consistently in drainage from the Port but do not appear to be a significant surface water concern off-site. It has not been determined if these compounds are present in the ground water. Future inspections at the Port should include assessment of potential sources of 1,2-dinitrophenol, pentachlorophenol, and isophorone. A water sample for cadmium analysis should be collected at the outlet of Juvenile Pond.

REFERENCES

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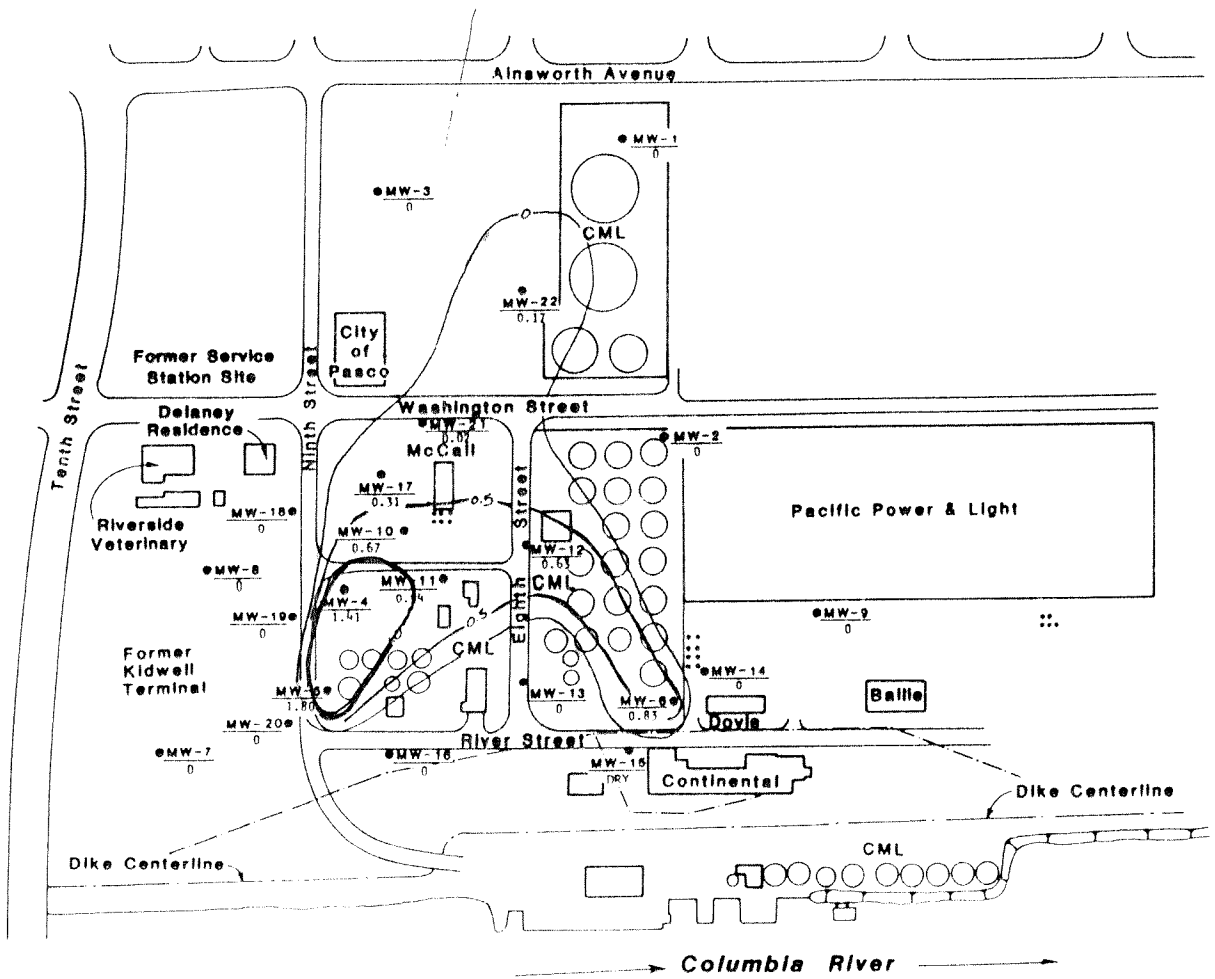
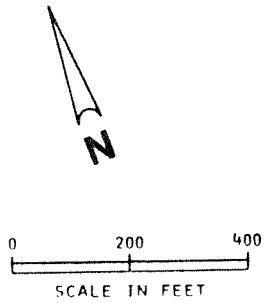
Appendix I. GeoEngineers, Inc. preliminary data on product thickness at Port of Pasco.





EXPLANATION:

MW-6 / 1.80 MONITOR WELL LOCATION AND NUMBER / FREE PRODUCT THICKNESS ON 3-16-87

0.5 APPARENT FREE PRODUCT THICKNESS CONTOUR BASED ON 3-16-87 MEASUREMENTS

CORP OF ENGINEER'S PERFORATED DRAIN LINE

NOTE: PRODUCT THICKNESS CONTOUR LINES SHOULD BE CONSIDERED AS APPROXIMATE AND ARE SUBJECT TO CHANGE WITH THE INSTALLATION OF ADDITIONAL MONITOR WELLS AND WITH TIME AS MORE MONITOR WELL MEASUREMENTS ARE COMPLETED.

REFERENCE: DRAWING ENTITLED "MASTER DRAINAGE PLAN", BY A.D. STANLEY & ASSOCIATES, INC., DATED JUNE 1984.

GeoEngineers Incorporated

PRODUCT THICKNESS CONTOUR MAP

FIGURE 5

Appendix II.

Table 1. Results of Ecology/EPA Manchester Laboratory Analyses of Port of Pasco Samples Collected by WQIS and ERO on September 9-10, 1985 (Note data qualifiers)

Matrix	WATER					SEDIMENT		TISSUE
Sample Location	Sewer at Manhole No. 2	Well No. 2 at Columbia Marine Lines	Drain below O/W Separator		West Inlet to Juvenile Pond	Juvenile Pond Discharge to Columbia R.	East End of Juvenile Pond	West End of Juvenile Pond	Carp Muscle
Sample Number	#8086	#8087	#8088	#8089	#8090	#8091	#8094 / #8095	#8096	#8097
flow (cfs)	-	-	0.37	-	9.3	-	- / -	-	-
temp. (°C)	16.2	-	16.2	-	17.1	17.4	- / -	-	-
pH	6.5	-	6.5	-	6.4	6.7	- / -	-	-
specific cond. (umhos/cm)	606	2,120	675	672	684	713	- / -	-	-
tot. hardness (mg/L)	-	-	-	-	-	280	- / -	-	-
tot. susp. solids (mg/L)	5	180	11	4	7	7	- / -	-	-
oil & grease (mg/l)	1 U	130	1.4	1.1	1 U	2.1	0.3 / 0.2	0.2	-
% solids	-	-	-	-	-	-	- / 31	2	22
% ash	-	-	-	-	-	-	- / 93	21	-
Volatiles (ppb)									
1,1-dichloroethane	5 U+	2,500 U+	2.5 J+	2.7 J+	5 U+	5 U+	35 U / 38 U	43 U	-
1,1,1-trichloroethane	5 U+	2,500 U+	27 +	31 +	5 U+	5 U+	35 U / 38 U	43 U	-
1,2-dichloropropane	5 U+	2,500 U+	39 +	47 +	5 U+	5 U+	35 U / 38 U	43 U	-
tetrachloroethene	5 U+	2,500 U+	11 +	13 +	1 UJ+	3.7 UJ+	35 U / 38 U	5.7 J	-
toluene	5 U+	19,000 +	1 J+	1 J+	5 U+	5 U+	1 J / 38 U	43 U	-
ethylbenzene	5 U+	23,000 +	1 J+	1 J+	1 J+	5 U+	35 U / 38 U	43 U	-
total xylenes	5 U+	370,000 +	16 +	13 +	5 U+	5 U+	5 J / 38 U	43 U	-
methylethylbenzene + isomers	NI +	250,000 +	NI +	NI +	NI +	NI +	NI / NI	NI	-
trimethylbenzene + isomers	NI +	420,000 +	NI +	NI +	NI +	NI +	NI / NI	NI	-
methylpropylbenzene + isomers	NI +	140,000 +	NI +	NI +	NI +	NI +	NI / NI	NI	-
dimethylethylbenzene + isomers	NI +	110,000 +	NI +	NI +	NI +	NI +	NI / NI	NI	-
tetramethylbenzene + isomers	NI +	66,000 +	NI +	NI +	NI +	NI +	NI / NI	NI	-
2-hexanone	10 U+	5,000 U+	10 U+	10 U+	10 U+	10 U+	70 U / 100	86 U	-
4-methyl-2-pentanone	10 U+	5,000 U+	10 U+	10 U+	10 U+	10 U+	70 U / 59	86 U	-
trichloroethene	5 U+	2,500 U+	5 U+	5 U+	5 U+	5 U+	35 U / 44 UJ	3 UJ	-
Acid/Base-Neutrals (ppb)									
naphthalene	2 U+	28,000 +	2 U+	2 U+	2 U+	2 U+	1,400 U / 1,400 U	1,600 U	400 U
2-methylnaphthalene	2 U+	35,000 +	2 U+	2 U+	2 U+	2 U+	1,400 U / 1,400 U	1,600 U	400 U
2,3-dimethylnaphthalene	NI +	6,900 J+	NI +	NI +	NI +	NI +	NI / NI	NI	NI
acenaphthene	2 U+	300 J+	2 U+	2 U+	2 U+	2 U+	1,400 U / 1,400 U	1,600 U	400 U
phenanthrene	2 U+	1,500 J+	2 U+	2 U+	2 U+	2 U+	1,400 U / 1,400 U	1,600 U	400 U
2,5-dimethylphenanthrene	NI +	1,500 J+	NI +	NI +	NI +	NI +	NI / NI	NI	NI
2-methylanthracene	NI +	3,700 J+	NI +	NI +	NI +	NI +	NI / NI	NI	NI
tetraeththyl lead	NI +	570 J+	NI +	NI +	NI +	NI +	NI / NI	NI	NI
pentachlorophenol	2 U+	3,000 U+	2 U+	2 U+	2 U+	2 U+	1,400 U / 1,400 U	860 J	400 U
hexadecanoic acid	NI +	NI +	NI +	NI +	NI +	NI +	130,000 J / present	NI	NI
sulfur	NI +	NI +	NI +	NI +	NI +	NI +	36,000 J / NI	NI	NI
Pesticides/PCBs (ppb)									
P,P'-DDE	0.002 U+	0.002 U+	0.002 U+	0.002 U+	0.002 U+	0.002 U+	5 U+ / 5 U+	5 U+	35 +
PCB-1254	0.04 U+	0.04 U+	0.04 U+	0.04 U+	0.04 U+	0.04 U+	60 U+ / 60 U+	60 U+	300 +
Metals (ppb)									
copper	68 *	68 *	66 *	60 *	68 *	45 *	NA / NA	89,400	-
zinc	21 *	6 *	50 *	47 *	11 *	15 *	NA / NA	88,300	-
nickel	24 *	5 *	38 *	1 U*	30 *	10 *	NA / NA	-	-
chromium	1 U	1 U	1 U	15	1 U	1 U	NA / NA	28,000	-
cadmium	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	NA / NA	190	3 U
lead	13	246	1 U	1 U	1 U	6 U	NA / NA	50,400	162
mercury	0.05 U	0.90	0.05 U	0.05 U	0.05 U	0.05 U	NA / NA	8	38
arsenic	4	107	8	2	8	8	NA / NA	4,100	-
Miscellaneous (ppb)									
cyanide	5 U	220	5 U	5 U	5 U	5 U	- / -	-	-

AV/OP1/86/060316

U = Not detected at detection limit shown
J = Estimated concentration
+ = Holding time exceeded in analysis
- = Analysis not requested
* = Blank contamination
NI = Not identified
NA = Not analyzed (lab lost sample)